

Custom Trunk Support

by

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and

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Illustrations by

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and

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The Rehabilitation Institute

6301 Northumberland Street ♦ Pittsburgh, PA 15217 ♦ 412/521-9000

One of the primary reasons to use any trunk support is to help a person maintain an upright position and to facilitate optimal functioning. Without this support, a number of functional activities are negatively affected, one of which is the speech process.

The Speech Process

The normal speech process begins with inhalation. As the lungs fill with air, the diaphragm moves in a downward direction, the abdominal and thoracic cavities expand outward, and the shoulders/clavicles stay depressed. At the end of inhalation the breath can be held so that a swallow may proceed.

In exhalation, the lungs empty their tidal volume as the diaphragm moves in an upward direction, the organs in the abdominal cavity move inward, the thoracic cavity compresses, and again, the shoulders/clavicle remain depressed. For the speech process to be successful, "control" of the musculature is required to gradually empty the tidal volume in the lungs, thus extending the exhalation stage of breathing which is important for producing words and sentences.

When a person falls forward or laterally, it significantly compresses the space for the diaphragm to move downward, the organs in the abdominal cavity to move outward and the thoracic cavity to expand, thus affecting respiration and phonation.

The lack of trunk support can have far reaching effects on other functional activities, as well. It interferes with appropriate social interaction by the loss of eye contact, visual orientation to the communication partner or other environmental stimuli. Drooling is usually more pronounced which may inhibit others from approaching the individual as a communication partner. This poor positioning also prevents optimal hand functioning.

The Problem

Trunk supports have traditionally been used to achieve an upright position for facilitating speech. However, the trunk supports on the market are usually made of molded, thick, polyurethane materials that are heavy, cumbersome and difficult to adjust. They surround the trunk like a cage and tend to enclose the trunk rather than support it. Individuals who require this type of trunk support because of weak thoracic musculature, need to rely on the more primitive "belly breathing" for adequate respirations. These types of systems do not facilitate deep "belly breathing", scapular adduction with depression, and thoracic extension, necessary for facilitating respiration and phonation.

The Solution

The Custom Trunk Support was originally designed at The Rehabilitation Institute to solve the problem of trunk support in severely head injured persons with physical

disabilities. It has since been modified to help both pediatric and adult individuals with physical disabilities of other origins as well. (See Figure 1)

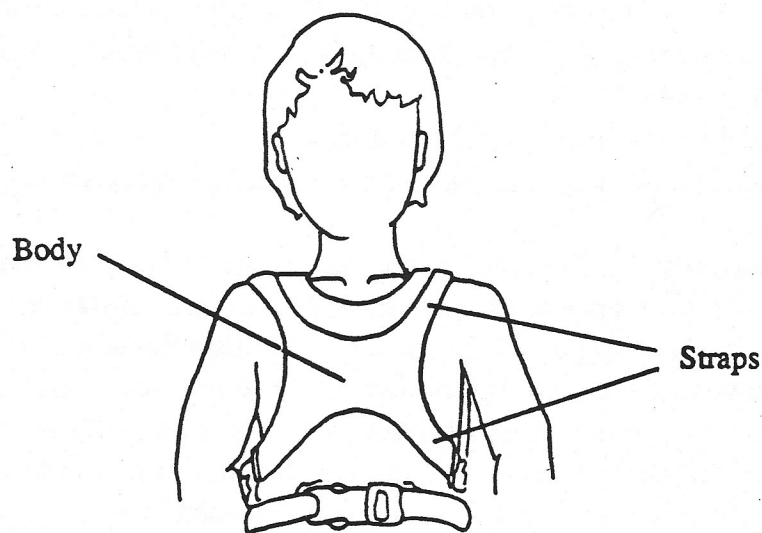


Figure 1

The Custom Trunk Support provides a light-weight alternative to typical molded trunk supports while giving the necessary sternal support to help an individual maintain an upright position. As illustrated in Figure 1, the Custom Trunk Support, in its design, frees the sterno-clavicular joints. The bottom edge of the support follows the rib cage margin up to the xiphoid process. Tension on the straps disperses the pressure throughout the Custom Trunk Support and over more of the bony prominences of the chest. All of these design features combine to achieve scapular depression and freedom for the abdomen to expand, thereby facilitating deep diaphragmatic breathing rather than clavicular respiration patterns. Although the tension on the Custom Trunk Support is enough to maintain an upright position, it is still able to "give" to allow thoracic expansion during respirations.

The Custom Trunk Support is made from medium-weight elk hide and is custom-designed to conform to each individual. Fabrication of the trunk support entails cutting it out of the elk hide with shears and fastening attachments to both the support and the seating system. Several different materials have successfully been used as attachments. *(For a copy of the instructions for fabricating the Custom Trunk Support, send a self-addressed stamped envelope to Marybeth Trapani-Hanasewych, M.S., CCC-SLP, The Rehabilitation Institute, 6301 Northumberland Street, Pittsburgh, PA 15217.)*

It is important that the Custom Trunk Support be used with a hip support seat belt. The seat belt is needed to maintain pelvic alignment and client safety.

The Advantages

The advantages of the Custom Trunk Support include:

- Therapists have control to individualize the support to each child.
- Internal rotation of the arms which causes flattening of the rib cage and inadequate respiration patterns (frequently seen with typical molded trunk supports), is prevented.
- The lightweight material reduces bulkiness.
- Elk hide leather breathes, and therefore, does not produce or trap excess perspiration.
- Easy-to-use attachments encourage the caregivers to use the system.
- The Custom Trunk Support has proven to be durable; however, it must be protected from drooling, food and drink. Although the edges of the leather can be protected with a leather edge-coat, additional measures such as a bib may be necessary during periods of excessive drooling or meals. The leather is not washable but with proper care, the support can last in excess of a year before replacement is necessary, or if drooling is not present, for the potential life of the chair as long as growth alignments remain appropriate.
- It can be adjusted in minimal time by trimming it with a pair of shears.
- Ventilation can be added without any significant loss of function. A leather hole punch can be used to make ventilation holes.
- There is vast adjustability in the size and placement of attachments and attachment straps. This adjustability permits changes for growth or winter clothing.
- It can eliminate lateral supports in some cases, thereby, reducing the cost of a wheelchair system.
- It can be used with other pieces of equipment such as supine standers or long-sitters.
- It has proven to be cost-efficient due to the low cost of materials and fabrication.
- For insurance re-imbursement, the Custom Trunk Support should be ordered as part of an entire wheelchair system.

In addition to the above advantages, the static positioning provided by the Custom Trunk Support can help achieve and maintain active postural alignment. It can also facilitate improved trunk control when used in conjunction with therapy.

Fabrication Instructions for the Custom Trunk Support

by

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Please read all steps before beginning fabrication.

Equipment needed

For the Pattern:

Butcher paper (1 inch in all directions larger than individual's torso)
Pencil
Scissors

For Assembling the Custom Trunk Support:

Medium weight leather (elk hide is recommended for its durability and availability in leather supply stores)
Felt tip marker (thin)
Shears (heavy duty; designed to cut leather, upholstery, etc.)
Leather edge-coating
Cotton swabs
Sewing Machine (heavy duty; able to sew leather)
1/4" or 3/8" drill with a 1/8" drill bit (to make pilot holes for screws)
Screwdriver

For Attachments: *(To determine which attachments to use, please read all instructions first.)*

Velcro/D-ring Attachments: (see page 4)

Velcro hook and loop - (for a person weighing 60 pounds or less, use velcro one-inch in width; 60 pounds or more, 1-1/2 inches in width)
4 D-rings and chafes
Dacron webbing - (optional, to reinforce the velcro; same width as velcro)
4 Phillips head screws (#8 or #10), 3/4 inch long
4 Finish washers

Dacron Webbing/Side-Release Buckle Attachments: (see page 5)

Dacron webbing - (for a person weighing 60 pounds or less, use webbing one-inch in width; 60 pounds or more, 1-1/2 inches in width)
4 Side-release buckles and tri-glides
4 Phillips head screws (#8 or #10), 3/4 inch long
4 finish washers

Dacron Webbing/Cam-Lever Buckle Attachments: (see page 8)

Dacron webbing - (for a person weighing 60 pounds or less, use webbing one-inch in width; 60 pounds or more, 1-1/2 inches in width)
2 Cam - lever buckles
2 Phillips head screws (#8 or #10), 3/4 inch long
3/16" drill bit (to drill a hole in the cam-lever buckle)

Pattern Instructions

1. Hold the paper against the individual's chest.
2. Determine the location of the top straps of the Custom Trunk Support. (See Figure 1) Find the center of one shoulder (midway between the shoulder joint and the neck) and mark the paper. Using this point as a centering guide, mark the width of the top strap.
 - 1-1/4 inch wide strap for an individual weighing 60 pounds or less
 - 1-3/4 inch wide strap for an individual weighing more than 60 pounds

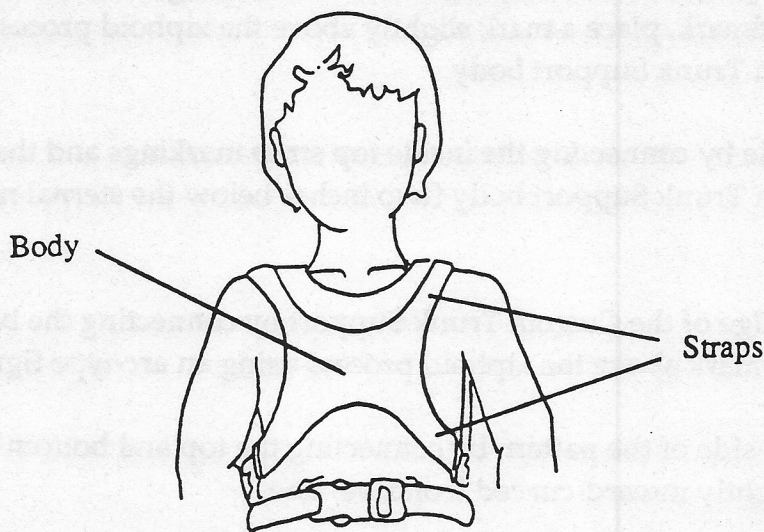


Figure 1

Repeat the above step to determine the location of the other top strap.

3. Determine the location and angle of the lower straps. It is necessary to first decide which Custom Trunk Support strap attachments will be used and where the attachments will be mounted to the seating system. (See the following section on "Assembling the Custom Trunk Support", specifically, the sub-sections on attachments.)

Ideally, the angle of the lower straps should be at 45-60°; a good rule of thumb to use is that the top edge of the lower strap should follow the rib margin (the lower edge of the bottom-most rib). However, because the lower attachments must follow the same angle as the lower straps, it is also necessary to consider at this time, *where* the attachments will be mounted to the seating system. The availability of mounting points is sometimes compromised by other equipment in the chair (e.g., lateral supports, hip guides, etc.). Mounting the attachments on the frame of a wheelchair may be an option where existing hardware permits this. The wheelchair frame can also be drilled for mounting sites when such drilling does not weaken the frame or invalidate the warranty.

Once you've determined the angle, mark the width of the bottom strap at the individual's side. Remember to use the guidelines above in step #2 to determine the strap width.

Repeat this step to determine the location of the other lower strap.

4. Locate the sternal notch (where the top of the breastbone meets the collar bones). The top edge of the body of the Custom Trunk Support should be approximately two inches below the sternal notch. Mark this point.
5. Locate the xiphoid process (where the right and left rib margins meet the breastbone). Using this as a landmark, place a mark slightly above the xiphoid process for the bottom edge of the Custom Trunk Support body.
6. Create the neck hole by connecting the inside top strap markings and the mark at the top edge of the Custom Trunk Support body (two inches below the sternal notch) with a U-type figure.
7. Create the lower edge of the Custom Trunk Support by connecting the bottom lower strap markings with the mark above the xiphoid process using an arc-type figure.
8. Complete the right side of the pattern by connecting the top and bottom strap markings on the right with a slightly inward-curved (concave) line.

Repeat the above step on the left side of the pattern.

9. Cut the pattern out.
10. Hold the pattern against the individual for proper fit. Make adjustments as necessary using the criteria mentioned above in steps #2 and #3.
11. Label the front of the pattern with the word, "Front".

Assembling the Custom Trunk Support

1. Place the leather on a flat working surface with the finished-side down.
2. Place the pattern, front-side down, on top of the leather and trace it with a felt tip marker.
3. Cut the Custom Trunk Support out of the leather using heavy duty shears.
4. Place the support against the patient for a final fitting and make any necessary adjustments.

5. Seal and protect the cut edges of the leather by applying the leather edge-coating with the cotton swabs. Allow the edge-coat solution to dry for approximately 15 minutes before continuing.
6. If patterns were provided and you haven't yet considered the types of attachments to be used, choose the one that is best suited to the individual and the seating system, taking into consideration suggestions from the individual, caregivers, teachers and therapists. A combination of attachment types may be used, (e.g. velcro/D-ring attachments on the top straps and dacron webbing/side-release buckles on the bottom straps).

Velcro/D-Ring Attachments

Reasons for selecting:

- less costly
 - when convenience for the caregiver(s) is a concern (easier to manipulate than side-release buckles and can be adjusted more quickly)
 - can be used for both low and high back seating systems (however, it is the only attachment that can be used on the top straps when the seating system has a high back).
- a. Locate the mounting points of the upper attachments: the D-rings and chafes are to be mounted to the "front" of the back section of the seating system at approximately one inch below the shoulders (see Figure 2). The velcro/D-ring type of attachment can also be used for seating systems with a *low* back section. In this case, there is an option to mount the D-rings to the "back" of the back section if so desired. In both situations, the mounting point must be at the same angle as the top straps of the Custom Trunk Support.

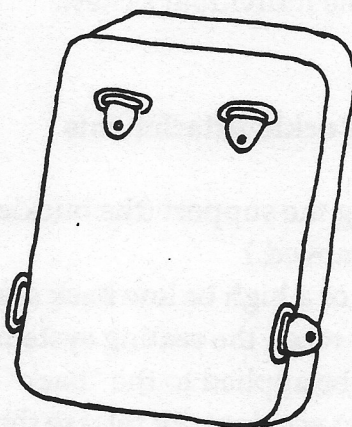


Figure 2

- b. Locate the mounting points of the lower attachments: the D-rings and chafes can be mounted to the "front" of or on the side "edge" of the back section. As with the upper

- attachments, they must be at the same angle as the straps of the Custom Trunk Support.
- c. Drill pilot holes in the back section of the seating system where the D-rings are to be mounted and attach all four D-rings and chafes with the screws and finish washers.
 - d. Cut four pieces of velcro "hook" approximately four inches long.
 - e. Sew them to each of the four Custom Trunk Support straps, leaving one inch of uncovered leather at the end of the straps.
 - f. Cut four pieces of velcro "loop" to a length determined by estimating the distance from the one inch of uncovered leather, underneath and through the D-ring, and back overtop of the velcro hook to the point, two inches below the lower edge of the hook. Repeat this step for each strap.
(If the option of using dacron webbing to reinforce the velcro will be used, cut the webbing to the same length of each piece of velcro loop and sew the two together, loop-side up.)
 - g. Sew one end of the velcro loop (again, loop-side up) to the Custom Trunk Support strap in the one inch of uncovered leather space at the end of each strap.

Repeat the above step for each of the three remaining Custom Trunk Support straps.

- h. A final adjustment can now be made for proper fit of the Custom Trunk Support. The bottom straps should be adjusted first so that the lower edge of the Custom Trunk Support body is above the xiphoid process. Adjust the top straps so that the fit is snug; however, abdominal-thoracic expansion should not be restricted. A rule of thumb for fitting is that two adult fingers should be able to slide between the Custom Trunk Support and the individual's chest.

Dacron Webbing/Side-Release Buckle Attachments

Reasons for selecting:

- for consistency in applying the support (the buckles always remain in the same place unless deliberately moved.)
 - for the lower attachments of a high or low back seating system
 - for the upper attachments when the seating system has a low back section, which allows the attachments to be applied to the "back" of the back section
 - more difficult for patient to accidentally release the support
- a. Cut four pieces of dacron webbing approximately three inches long.
 - b. Take one piece of the cut dacron and thread it through the loop of the female portion

of a buckle, doubling the dacron.

- c. Sew the dacron (doubled thickness) to one of the Custom Trunk Support straps, positioning the female buckle portion so that 1/2-inch of leather is extending beyond the top edge of the buckle. (See Figure 3)

Repeat steps "b" and "c" on all three remaining straps.

- d. Cut four pieces of dacron webbing approximately 18-24 inches long.
- e. Take one piece of the cut dacron and feed it through the tri-glide from underneath one side, over the cross bar and down through the other side.

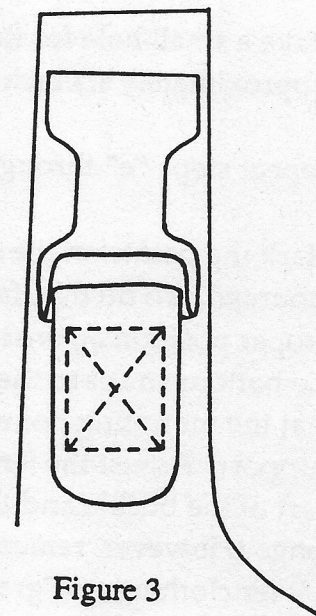


Figure 3

- f. Take the male portion of the buckle in hand and hold it with the slanted edge on top and facing the piece of dacron being held in the other hand (Figure 4). Feed one end of the dacron webbing through the buckle by sliding it through the bottom slot first (Figure 5) and looping it back through the top slot (Figure 6). *(If threaded correctly, the slanted edge will act as a "stop" for the dacron webbing when the buckle and dacron combination is held taut. If the dacron webbing pulls through and is not "stopped", the buckle was held incorrectly when threaded. Thread the male portion of the buckle again from the other side.)*

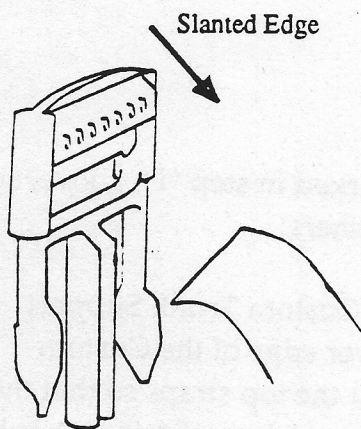


Figure 4

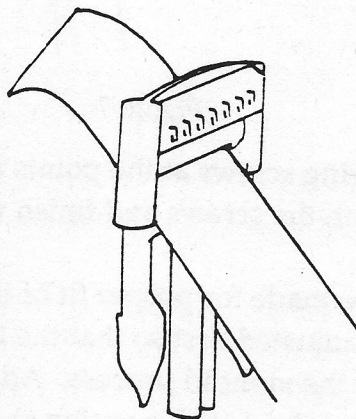


Figure 5

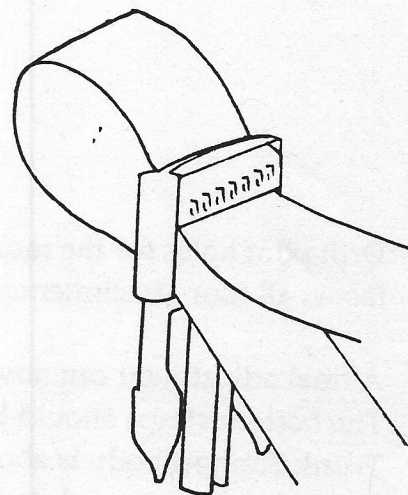


Figure 6

- g. Feed the end of the dacron webbing (that was just looped through the buckle) back through the tri-glide to secure it.

- h. Make a small hole for the mounting screw in the other end of the dacron webbing (approximately 3/4 inch from the edge).

Repeat steps "e" through "h" for the other three buckles (male portion).

- i. Mark the points on the seating system where the dacron webbing straps are to be mounted. To do this, fasten all four buckles and hold the Custom Trunk Support in proper position against the individual's chest. Pull the top straps to the "back" and the bottom straps to the side "edge" of the seating system (see Figure 7). Make sure that the mounting points maintain the angle of each strap of the Custom Trunk Support. Adjust the length of the dacron as necessary by pulling it through the male part of the buckle and the tri-glide. The dacron webbing may be trimmed if it is too long. (However, remember to leave enough dacron webbing to accommodate winter clothing and growth.)

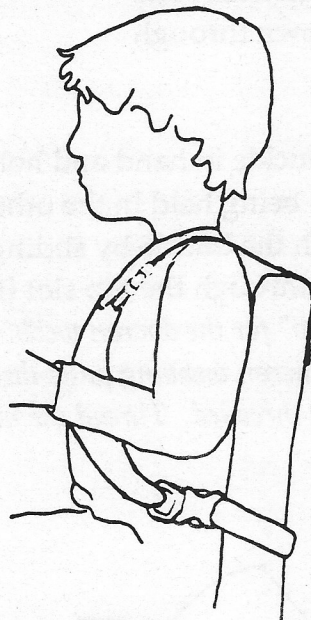


Figure 7

- j. Drill pilot holes for the mounting screws at the points marked in step "i", above, and fasten all four attachments with the screws and finish washers.
- k. A final adjustment can now be made for proper fit of the Custom Trunk Support. The bottom straps should be adjusted first so that the lower edge of the Custom Trunk Support body is above the xiphoid process. Adjust the top straps so that the fit is snug; however, abdominal-thoracic expansion should not be restricted. A rule of thumb for fitting is that two adult fingers should be able to slide between the Custom Trunk Support and the individual's chest.

Dacron Webbing/Cam-Lever Buckle Attachments (Top straps only)

Reasons for selecting:

- when convenience for the caregiver(s) is a concern (easier to manipulate than side-release buckles and can be adjusted more quickly)
- for the upper attachments when the seating system has a low back section, which allows the attachments to be applied to the "back" of the back section
- patient cannot accidentally release the support

- a. Cut two pieces of dacron webbing approximately 18-24 inches long.
- b. Take an end of one piece of the cut dacron and overlap one-inch on the end of a Custom Trunk Support leather strap. Sew them together.

Repeat this step for the other top strap.

- c. Mark the areas where the cam-lever buckles will be mounted by holding the Custom Trunk Support in proper position against the individual's chest. Pull the top straps to the "back" of the seating system and make sure that the buckles will be mounted at the same angle as each of the top Custom Trunk Support straps (See Figure 8).

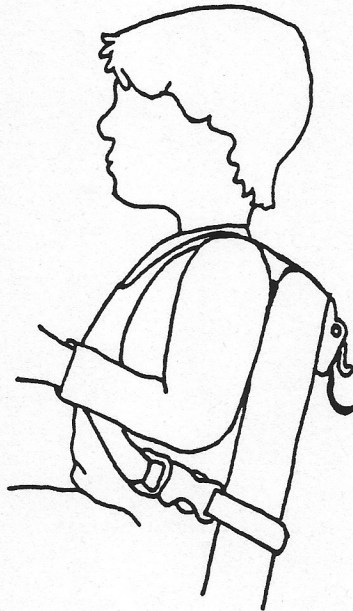


Figure 8

- d. Drill a hole in the center of the wide crossbar of a cam-lever buckle using a 3/16" drill bit.

Then drill a pilot hole in the back of the seating system (with a 1/8" drill bit) at the location marked for the cam-lever buckle in step "c", above.

Attach the cam-lever buckle to the seating system with a screw.

Repeat this step for the other top strap.

- e. Thread the dacron strap down into the buckle with the lever in the open position, then push the lever down to the "locked" position to secure the strap.
- f. The attachments for the bottom straps should be chosen from the other two varieties (Velcro/D-ring or Dacron/Side-Release Buckle.) Refer to those sections above for instructions.
- g. A final adjustment can now be made for proper fit of the Custom Trunk Support. The bottom straps should be adjusted first so that the lower edge of the Custom Trunk Support body is above the xiphoid process. Adjust the top straps so that the fit is snug; however, abdominal-thoracic expansion should not be restricted. A rule of thumb for fitting is that two adult fingers should be able to slide between the Custom Trunk Support and the individual's chest.

Appendix

Distributors and Manufacturers of Buckles/Velcro/Dacron Webbing

Cascade Orthopedics
25 Willow Springs Circle
York, PA 17402
(717) 764-1265

Durr - Fillauer
P.O. Box 5189
Chattanooga, TE 37406
1-800-251-6398

Knit-Rite, Inc.
2020 Grand Avenue
P.O. Box 410208
Kansas City, MO 64141
1-800-821-3094

Feiner Brothers
20 East Second Street
Mineola, NY 11501
(516) 746-2120

Consumer Care Products, Inc.
P.O. Box 684
810 N. Water Street
Sheboygan, WI 53082

Leather Manufacturers

Roden Leather Company
172 S. Crooks Road
Royal Oak, MI 48168
(313) 542-7064

Tandy Leather Company
5022 William Penn Highway
Monroeville, PA 15146
(412) 733-2930

Participants and Observers at Student-Teacher Meetings

Carol A. Dwyer
25 Willow Springs Court
York, PA 17403
(717) 764-1155

John E. Turner
P.O. Box 3189
Chambersburg, PA 17222
(717) 324-8322

Kenneth R. Jir
2500 Grand Avenue
P.O. Box 110258
Kansas City, MO 64111
(800) 821-0391

Robert B. Brown
10 East Second Street
Albany, NY 12201
(518) 745-2120

Colin W. C. Thompson, Jr.
P.O. Box 584
210 N. West Street
Sheboygan, WI 53081

Teacher Participants

Robert L. Leach, Co-Principal
171 S. Oak Street
Pottsville, PA 17860
(610) 324-1004

Carol L. Leach, Co-Principal
5012 Williams Farm Highway
Monaca, PA 17146
(610) 324-1004

≡≡≡ TRI Custom Trunk Support Order Form ≡≡≡

Please send me the TRI Custom Trunk Support fabrication kit. The kit includes:

- | | |
|---|--|
| 2 pieces of black leather | 4 pieces of 1-inch webbing, each 24 inches in length |
| 4 side-release buckles | 4 pieces of velcro loop, each 24 inches in length |
| 4 D-rings and chafes | 4 pieces of velcro hook, each 4 inches in length |
| 4 tri-glides | 1 container of edge-coat |
| 2 pieces of elk hide, approx. 12" x 14" | 1 Q-tip applicator |

I have enclosed a check for \$60 for each kit payable to Blackburn's Physicians Pharmacy, Inc.
The cost includes shipping and handling inside U.S.A. Please include \$15 for each kit for shipping outside U.S.A.
[Please type or print]

Name			
Address	City	State	Zip
Office (day) phone	Fax		

Send to TRI Custom Trunk Support, Blackburn's Physicians Pharmacy, Inc., 301 Corbet Street,
Tarentum, PA 15084. Phone 800-472-2440. Fax 412-224-9124.

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